Simulating Complex Galaxy Images

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December 6, 2016

Outline

- Why we want to test weak lensing codes with complex galaxies
- A new GalSim module
- Some pretty pictures

Weak Lensing Model Bias

- The ellipticity is a good shear estimator if the galaxy is well described by a single ellipse.
- Most real galaxy are not ellipses.

Real Galaxies

Real Galaxies

Real Galaxies

Real Galaxies

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Real Galaxies

Real Galaxies

Weak Lensing Model Bias

- Most shear measurement algorithms fit some kind of simple elliptical model, and this results in "model bias".
- Fitting more complex models is not possible: unstable
- With

Simulations

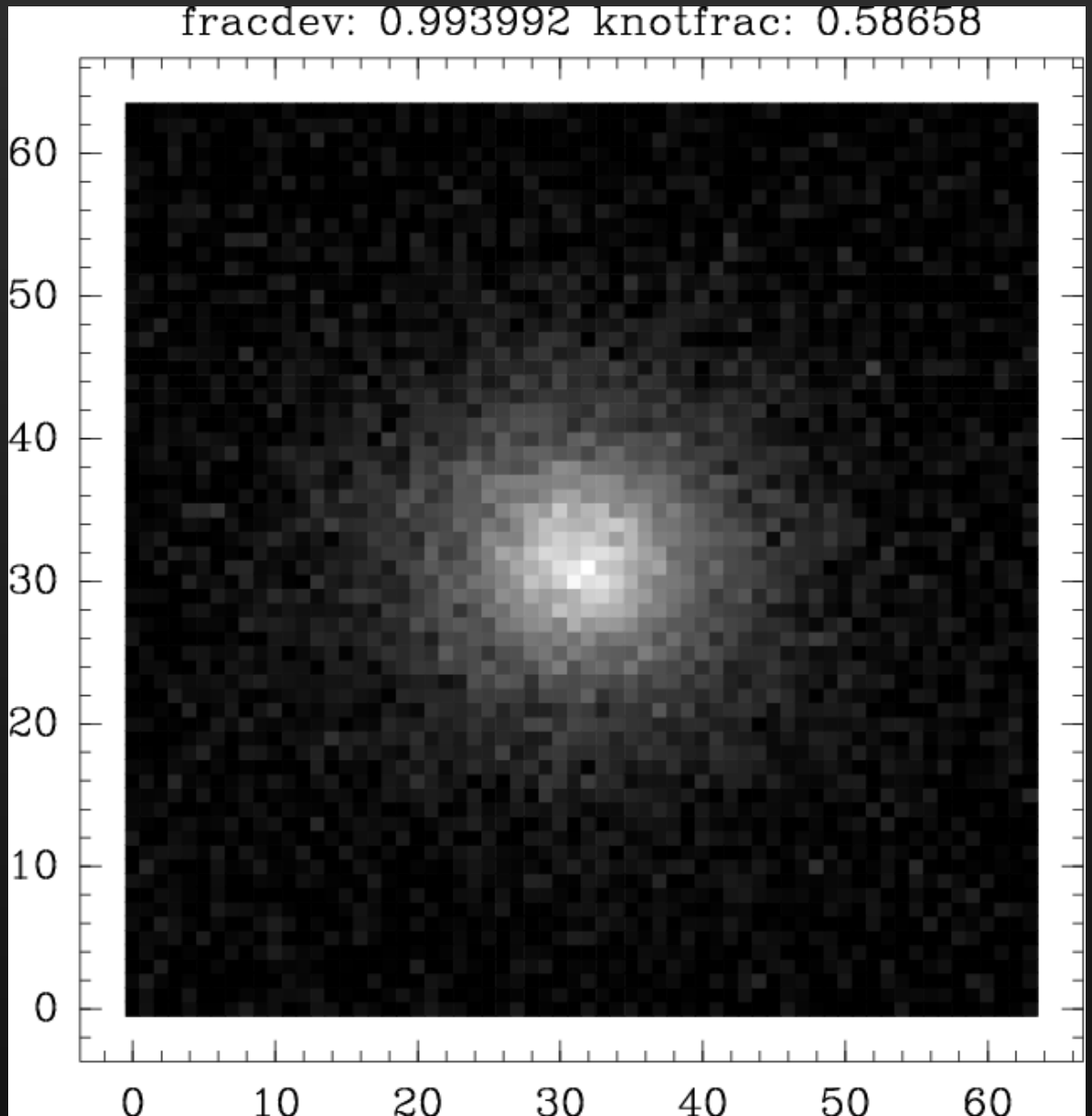
- Most common method to test model bias is to use HST images.
- Take real images, shear them, add extra noise, degrade psf
- This is very expensive

Alternate way: random walk

- Mentioned in Zhang et al. 2010 but with no details or code given; I implemented and added to Galsim
- Let a set of point sources take a "random walk" over the image
- Scale to requested scale radius and ellipticity
- Can represent an "irregular" galaxy, or can add to bulge+disk model to simulate knots of star formation.

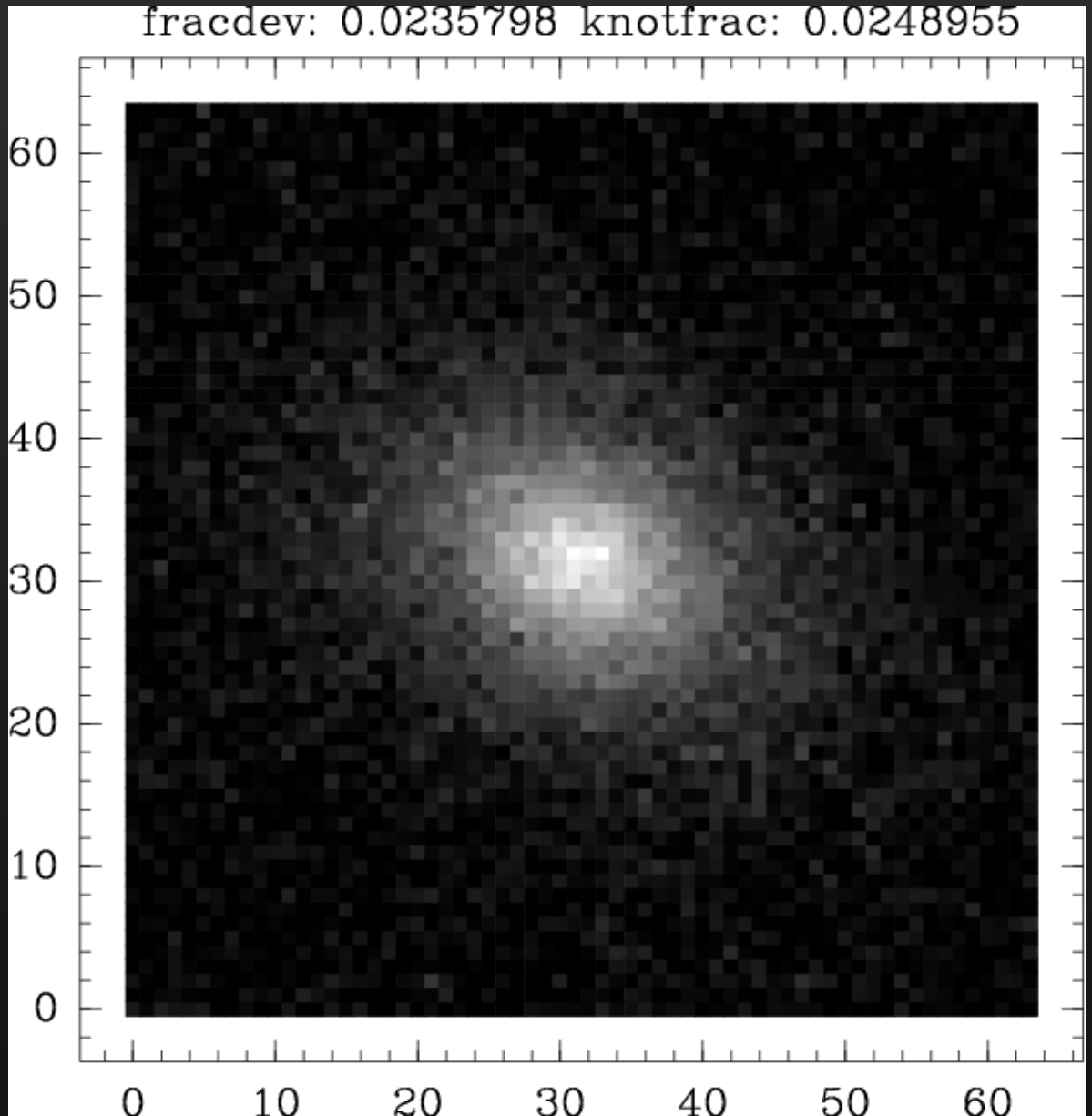
Example Simulated Galaxies

Mostly bulge-like



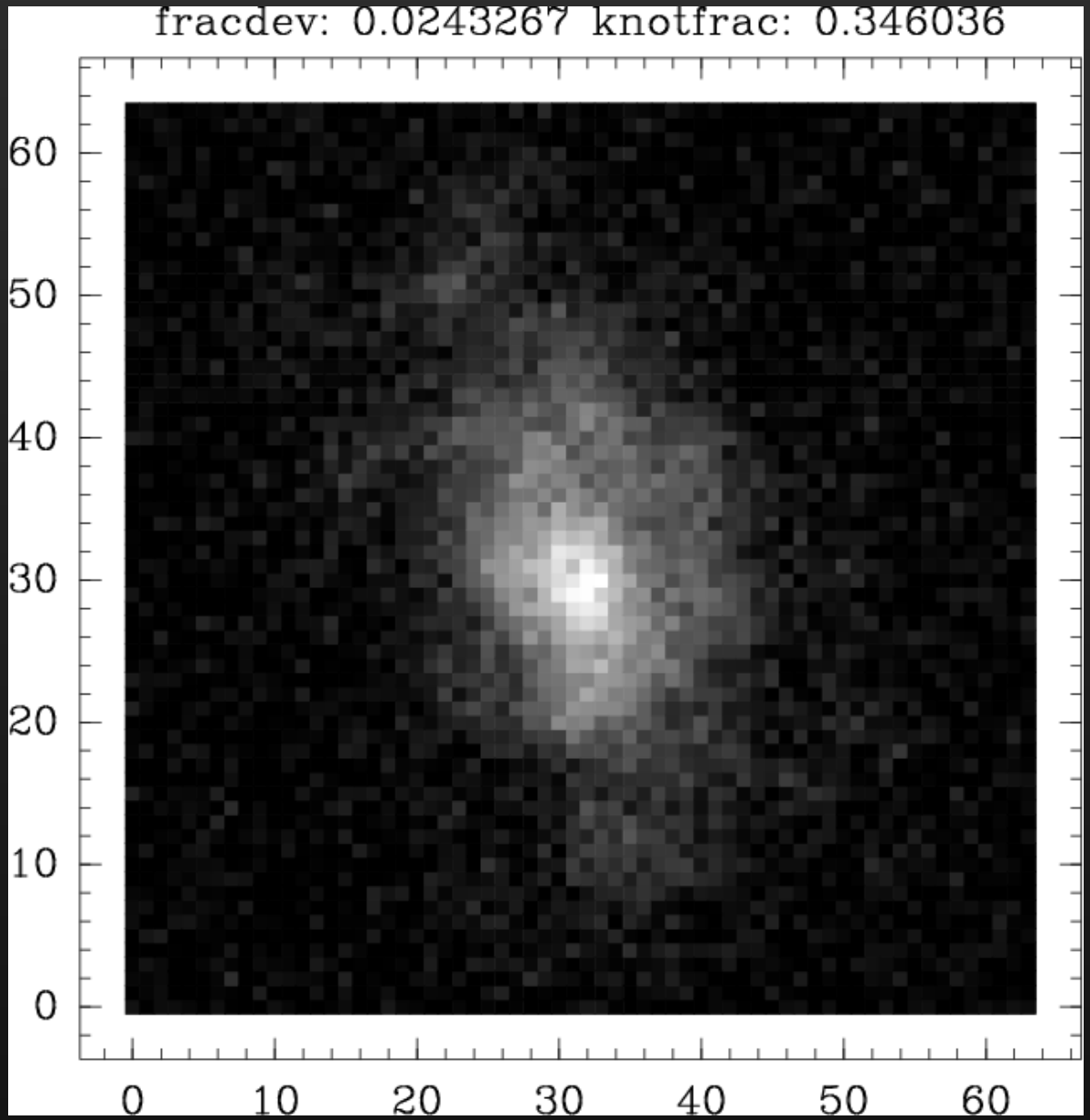
Example Simulated Galaxies

Mostly disk-like



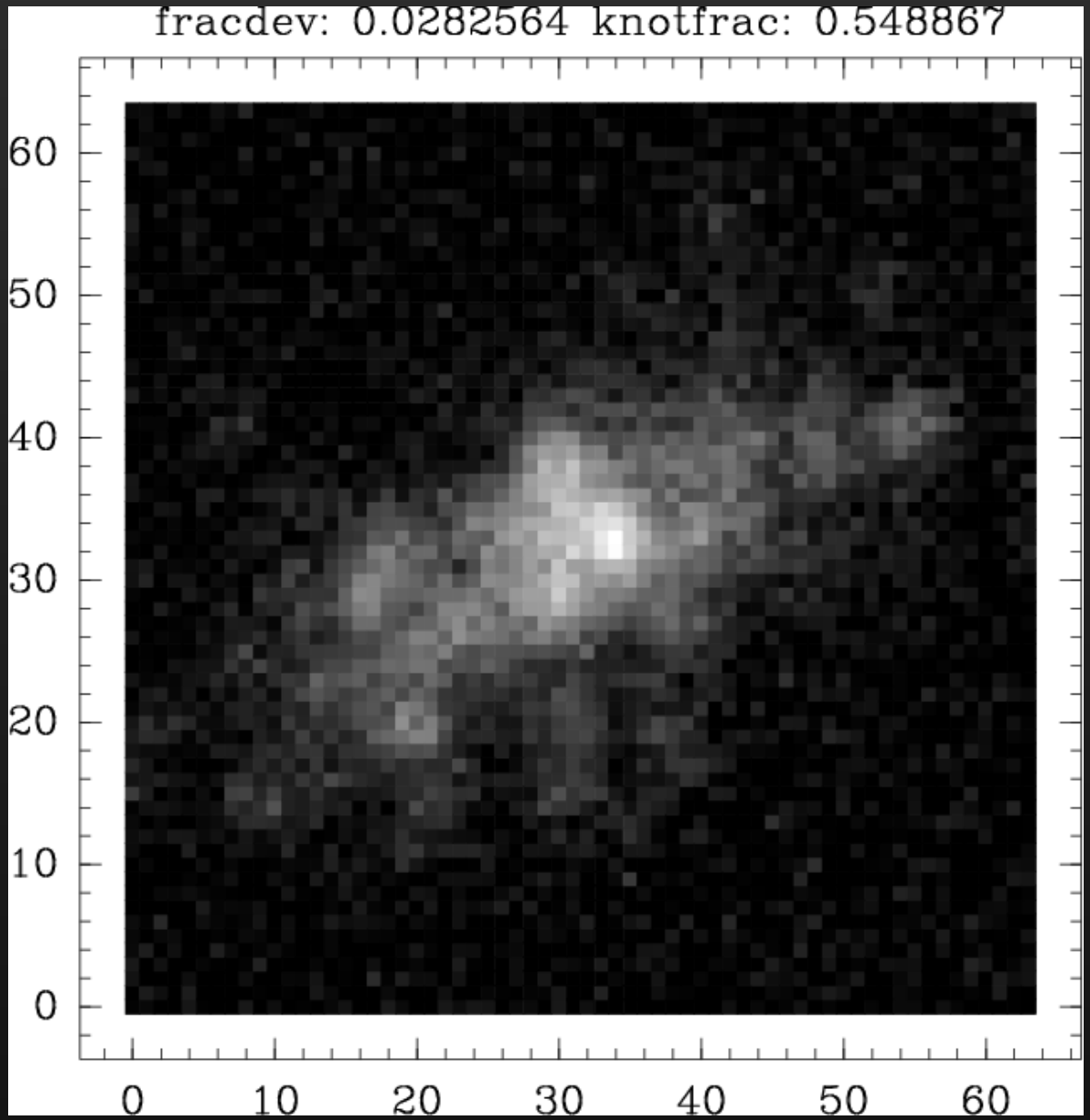
Example Simulated Galaxies

disk-like with some knots of star formation



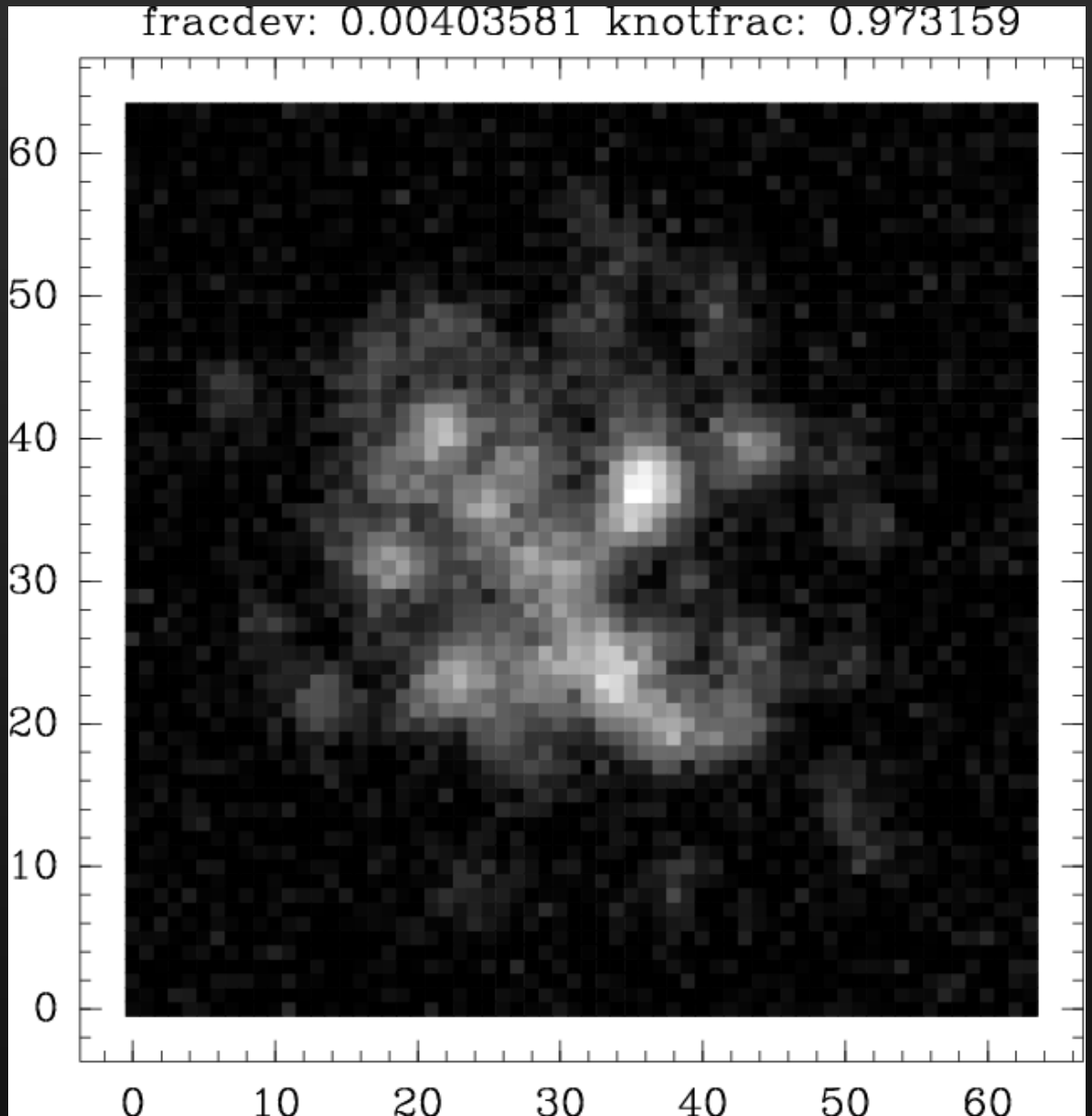
Example Simulated Galaxies

disk-like with more knots of star formation



Example Simulated Galaxies

mostly irregular



Metacalibration

- I've been using these to test metacalibration
- Ten times faster than using HST images.
- So far metacal passes all tests.